We claim:

1. An apparatus, comprising:

a length of a solid dielectric photonic band-gap fiber material having holes;

a core located within said length; and

a gain medium located within said length, wherein said gain medium comprises a mixture of at least one buffer gas and an alkali atomic vapor having a D_1 transition, wherein said at least one buffer gas has the dual purpose of collisionally broadening a D_2 transition of said alkali atomic vapor and collisionally transferring pump excitation from the upper level of said D_2 transition to the upper level of said D_1 transition at a rate larger than the radiative decay rate of either of these two levels.

2. The apparatus of claim 1, wherein said core is hollow, wherein said gain medium is located within said core.

3. The apparatus of claim 2, wherein said gain medium is further located within said holes.

4. The apparatus of claim 1, wherein said gain medium is located within said holes.

5. The apparatus of claim 4, wherein said core is hollow.

6. The apparatus of claim 5, wherein said gain medium is located within said core.

7. The apparatus of claim 4, wherein said core comprises a solid dielectric material.

8. The apparatus of claim 1, further comprising a cladding surrounding said length, wherein said cladding has a lower refractive index than said length.

9. The apparatus of claim 1, wherein said alkali vapor is selected from K, Rb, and Cs, said apparatus further comprising means for optically pumping said gain medium.

10. The apparatus of claim 9, wherein said means for optically pumping said gain medium comprises a laser diode.

11. The apparatus of claim 10, wherein said laser diode is selected from a group consisting of a single stripe laser diode, several single stripe laser diodes, a laser diode bar, several laser diode bars and a fiber-coupled laser diode.

12. The apparatus of claim 10, wherein said laser diode is configured to optically pump said gain medium at 767 nm, 780 nm, or 852 nm.

13. The apparatus of claim 1, wherein said at least one buffer gas is selected from a group consisting of He, Ne, Kr, and Xe.

14. The apparatus of claim 1, wherein said gain medium comprises an additional fine structure ($^2P_{3/2} - {}^2P_{1/2}$) quenching gas.

15. The apparatus of claim 14, wherein said fine structure quenching gas is selected from the group consisting of methane and ethane.

16. The apparatus of claim 1, wherein said holes are sealed at the ends of said length.

17. The apparatus of claim 16, wherein said core is open at each end of said length.

18. The apparatus of claim 1, further comprising means for holding said gain medium at a temperature T_1, wherein said length comprises a hollow fiber optic that is contiguously connected to two ovens, one at each end held at temperature T_2 and T_3 respectively, wherein $T_1 > T_2, T_3$.

19. The apparatus of claim 18, wherein at least one oven of said two ovens incorporates a transparent optic, enabling optical access to the ends of said fiber optic.

20. The apparatus of claim 19, wherein said photonic-band-gap fiber optic is end pumped.

21. The apparatus of claim 1, further comprising means for optically pumping said gain medium.

22. The apparatus of claim 18, wherein said temperature T_1 is selected for the pump absorption to be >50%.

23. The apparatus of claim 10, wherein said gain medium produces light at 770 nm, 795 nm, or 895 nm.

24. A method, comprising:

providing a length of a solid dielectric photonic band-gap fiber material having holes, a core located within said length and a gain medium located within said length, wherein said length is configured in an optical cavity including an output coupler, wherein said gain medium comprises a mixture of at least one buffer gas and an alkali atomic vapor having a D_1 transition, wherein said at least one buffer gas has the dual purpose of collisionally broadening a D_2 transition of said alkali atomic vapor and collisionally transferring pump excitation from the upper level of said D_2 transition to the upper level of said D_1 transition at a rate larger than the radiative decay rate of either of these two levels; and

optically pumping said gain medium to produce laser output.

25. The method of claim 24, wherein said core is hollow, wherein said gain medium is located within said core.

26. A method, comprising:

providing a length of a solid dielectric photonic band-gap fiber material having holes, a core located within said length and a gain medium located within said length, wherein said gain medium comprises a mixture of at least one buffer gas and an alkali atomic vapor having a D_1 transition, wherein said at least one buffer gas has the dual purpose of collisionally broadening a D_2 transition of said alkali atomic vapor and collisionally transferring pump excitation from the upper level of said D_2 transition to the upper level of said D_1 transition at a rate larger than the radiative decay rate of either of these two levels;

providing an optical signal to be amplified in said gain medium; and

optically pumping said gain medium to amplify said optical signal to produce an amplified optical signal.